



Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

OBSERVATIONS ON AND EXPERIMENTS WITH
CUTEREBRA TENEBROSA COQUILLET¹

R. R. PARKER AND R. W. WELLS

The studies carried on by the Montana State Board of Entomology in the Powder River Valley in 1916 afforded the writers opportunity for chance observations on the rodent bot fly, *Cuterebra tenebrosa* Coquillet. Among over a thousand rodents captured for examination as possible hosts of the Rocky Mountain spotted fever tick, *Dermacentor venustus* Banks, two were found, each infested with a single larva of this bot fly. The larvae were reared to adults and the following notes were made.

Record No. 1518, June 29. Found infesting breast of a pack rat (*Neotoma cinerea*). Air hole about three-sixteenths of an inch in diameter. Rat afterward died from trap injury and larva was squeezed out and placed on dirt. It immediately crawled in, the hole being left open. The fly emerged on August 25 after an interval of 47 days.²

Record No. 1526, July 19. Large bot larva found infesting grasshopper mouse (*Onychomys leucogaster missouriensis*). It was embedded under the skin in front of the left hind leg. Larva emerged into bag in which mouse was placed for the ticks to crawl off. The adult emerged in Bozeman on Jan. 8, 1917, after an interval of 173 days.

On September 9, after returning to Bozeman, a living female of the fly was received in a box. The latter was left on the desk of the senior author for several days and when next examined was found to contain 186 eggs securely fastened to the pasteboard. They were not examined again until October 13, when the caps were removed from several eggs. Active larvae immediately crawled forth. This suggested the experimental infestation of rodents, and the experiments hereafter described were carried out. The larvae used were secured by removing the egg caps with a fine needle and gently assisting the larvae to make their escape. When the transfer was made to the mouth of the animal to be infested, the latter was made ready (prairie dogs were securely tied) and its mouth gently forced open and so held by a transverse pry. The cap of an egg was removed and the transfer made on the point of the needle as rapidly as possible and the animal released shortly thereafter.

1. Contribution from the Laboratory of the Montana State Board of Entomology, Bozeman, Montana.

2. This rat was also heavily infested with Siphonaptera and Anoplura as well as 45 larvae and nymphs of *Dermacentor venustus*.

Experiment 1. October 13. Four larvae transferred to the mouth of a prairie dog (*Cynomys ludovicianus*) and immediately disappeared. Three others were placed on a shaven spot on the neck, but it could not be seen that any effort was made to penetrate the skin. October 25, examination showed that 2 larvae had reached the subcutaneous tissue, one about at the middle of the left side (1), the other a little to the left of the middle beneath (2). Number 1 had punctured the skin and the larva was visible. It died about November 15, the abrasion healing quickly, leaving a hard lump that gradually disappeared. Number 2 was photographed on November 20 (Fig. 9) when the end could be seen very slightly protruding from the hole. It emerged during the following night and a photograph of the mature larva was made on November 21.

Experiment 2. This experiment was started with the hope that by using a considerable number of larvae, several being placed in the mouth at frequent intervals, that by subsequent dissection, the course of the larvae in the body might be traced. A prairie dog was again used as a host and 3 larvae were placed in its mouth on each of the following dates: October 27, 31, November 1, 2, 3, 4, 5, 6 and 7. A total of 27 larvae were used. On November 6 a small lump was noted on the belly, on November 7 this was slightly larger. On November 8 the host was killed and dissected, but no traces of the larvae were found either in the body cavity or tissues.

Experiment 3. Host, prairie dog. Three larvae were placed in its mouth on each of the following days, October 27 and 31, November 4 and 15. Larvae appeared under the skin as follows: (1) November 5 on right side, air hole noted on November 7; (2) November 16 on middle of neck dorsally; (3) November 17 slightly cephalad of (1) on right side; (4) November 17 slightly ventrad of (1) on right side; (5) November 17, on underside of left front thigh; (6) November 20, dorsal of middle of left side; (7) November 26 caudad and dorsad of left front leg.

On November 28, numbers 1, 4, 5 and 6 were dead, and numbers 2, 3 and 7 were still alive. Number 3 was removed, part of a cast skin coming with it. This was evidently the last molt and the chitin spangles had not yet become colored, the molt having apparently just taken place. The air hole was plugged at the time of removal. Numbers 4 and 7 emerged on December 13 and either crawled away or were destroyed by the dogs and were never recovered.

Experiment 4. Host, 13-striped ground squirrel (*Citellus tridecemlineatus pallidus*). Two larvae placed in its mouth on October 27 and 3 on November 21. Results negative.

Experiments 5, 6, 7 and 8. Hosts, Belgian hares. On November 8, 5, 4, 4 and 6, larvae were placed in the mouths of 4 Belgian hares, respectively. Results negative.

Experiment 9. Four larvae placed in the mouth of a prairie dog. December 14, 2 larvae appeared beneath the skin on the top of the fore shoulders. On January 8 one (1) was found to have emerged during the night, and on January 11 the second (2) was removed because of the condition of the host. This larva was located directly above the spine and was the only instance in which any of the prairie dogs gave evidence of being seriously affected by the presence of bot larvae. This dog had been used in one of the previous experiments. After removal the dog recovered rapidly. On January 8 number 1 was placed in a glass jar with 5 inches of dirt, on the 9th it had pupated about 2½ inches beneath the soil surface. Number 2 was placed in a similar jar on January 11, and after entering the ground voided considerable dark fluid from the anus. On January 12 it was still voiding similar excrementous matter. Pupation took place on January 14, but the insect died while in the pupal stage. On number 2, which was removed a little prematurely, the action of the larva in withdrawing and protruding the posterior spiracles indicated that the latter were protrusile before pupation. After pupation, however, they are

external as shown in figure 10. Number 1 had not emerged as an adult when the writers left Bozeman on March 25 for field work, and this record was never secured.

Experiment 10. On December 18 two larvae were placed in the mouth of a house mouse (*Mus musculus*). The host was dissected on December 20, but no larvae were found.

Naturally our curiosity was aroused as to where the eggs were deposited under natural conditions, the conditions under which the operculum was displaced, the manner in which the larva gained entrance to the host and course followed by the larvae in reaching the subcutaneous tissues. The following points are presented for what they are worth. The egg cap when dry requires sufficient force to remove it to make it seem doubtful if the larva within can be instrumental in forcing it off. When eggs are moistened with saliva a dark outlining band appears around the margin of the cap (Fig. 1). Of several eggs placed intact in preserving fluid the caps of several were later found to be off and the larvae slightly to almost wholly protruding. Whether the removal of the cap was due to the action of the larva upon being irritated by the fluid, which must have penetrated the egg slowly, or was due to some action of the fluid on the egg, is uncertain. At least, however, it seems evident that the caps must have become loosened very soon after being placed in the fluid, since the larvae were able to crawl part way out of the egg before being overcome. It is also of interest that though the eggs were deposited within a period of a few days following September 9, 1916, yet larvae in the eggs not used in the experiments were still active the following March, about six months later, and had not escaped from the eggs.

When larvae were removed from the egg and placed upon a surface they would immediately attach themselves by an apparently sucker-like organ (Fig. 4) at the posterior end of the body and sway the body back and forth. The same habit was observed when placed on the skin of an animal. It is the recollection of the writers that these minute larvae were able to move about to some extent, very much after the manner of an inch worm. Unfortunately, no notes were made on this point. It is distinctly recalled that the larvae looped themselves in the manner above suggested, and that in one instance a larva, removed from the egg and placed beside it on the box, was afterwards found several inches away. What may be the value of the ability to attach themselves is not evident. The eggs were firmly "glued" to the box in which they were laid, indicating that they are fastened to something when deposited under natural conditions. The ventral surface of the egg is broad on the posterior two-thirds and the surface of the egg on this area is somewhat sunken inward. If

this is a groove, it is certainly very wide and shallow if intended to be attached to a single hair. The eggs were all fastened by this surface. After the cap was removed a delicate membrane was frequently noted covering the opening; this had to be broken before the larvae could escape.

It is possible, if other related bot flies were kept alive when captured, that eggs and larvae might be secured in a similar manner and valuable and suggestive information gained concerning life histories and habits.

SUMMARY OF DATA RELATING TO LIFE HISTORY

1. Under natural conditions the larvae of *Cuterebra tenebrosa* were found infesting pack rats and grasshopper mice. Prairie dogs were infested under laboratory conditions, but negative results were secured with Belgian hares and 13-striped ground squirrels.

2. A female deposited 186 eggs within a period of several days. These eggs contained active larvae which were still alive after six months in the laboratory.

3. By mechanically transferring larvae from eggs to the mouths of prairie dogs infestation was secured. In three experiments with these animals (Exp. 2 excluded because the host was killed) 20 larvae were used, of which 11 reached the subcutaneous tissue, 5 died in this situation and 6 emerged as fully matured larvae. (One of these was dissected out just as it was completing the last molt.)

4. Evidence that the larvae had reached the subcutaneous tissue was found on the twelfth day in two instances, and within maximum limits of 9 and 10 days in two other experiments.

5. The length of time elapsing after the first apparent evidence of larvae under the skin and before the skin was punctured was about two days.

6. The period spent in the subcutaneous tissue was 17, 25, 26 and 27 days in the several cases observed.

7. The total period from infestation to the emergence of the fully developed larva was respectively 37, 38 and 47 days in three instances.

8. After emergence from the host the mature larva entered the ground and soon pupated a few inches below the surface.

9. The period between the emergence of the mature larvae from the host and that of the fly was 47 days (June to August) in one instance and 173 days in another (July to January 8).

10. Winter apparently may be passed in the pupal stage.

11. Prairie dogs seemingly experienced no serious effects from the presence of the larvae even when several were present simultaneously. Infested dogs sometimes seemed less active and often appeared to favor the part of the body infested. In one experiment in which the bot was located above the spine on the fore shoulders the most serious effects were noted. When larvae died in the dogs the air holes healed quickly leaving lumps that gradually disappeared.

EXPLANATION OF PLATE

Figure 1. Eggs moistened with saliva showing dark band demarking the operculum.

Fig. 2. Normal egg.

Fig. 3. Egg with cap removed.

Fig. 4. Larva just removed from egg. Note sucker-like extension posteriorly.

Fig. 5. Larva just after emergence from host.

Fig. 6. Anterior end of mature larva.

Fig. 7. Posterior end of mature larva.

Fig. 8. Adult, female.

Fig. 9. Infested prairie dog just before emergence of larva.

Fig. 10. Puparium. Note spiracle posteriorly.

Fig. 11. Posterior spiracles of nearly mature larva with breathing apparatus retracted.

Fig. 12. Same, with breathing apparatus extruded.

PARKER-WELLS—CUTEREBRA TENEBROSA

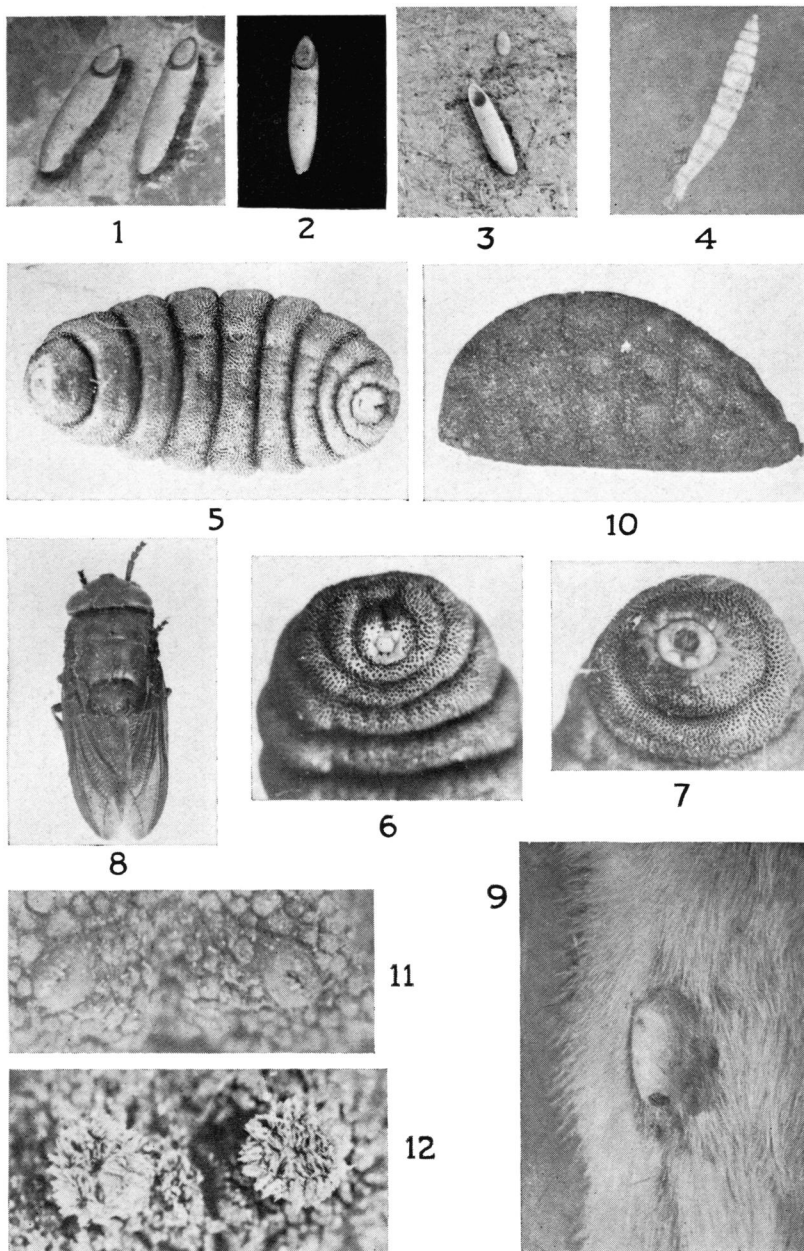


PLATE VIII